User's Guide

Desktop Edition

English

KEY to METALS

The World's Most Comprehensive METALS Database

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1 Introduction

KEY to METALS is a global database of metals, developed and designed for professional use worldwide. The world's most comprehensive metals database, **KEY to METALS** includes materials information from **more than 57 countries and standards** all over the world.

Before you start using this product, let us remind you about the benefits that **KEY to METALS** offers you:

- **KEY to METALS** adds **a** large amount of **carefully collected and analyzed content**.
- Keeps **only** carefully, **multiplied**, checked data and information.
- **Ties it all into a unique, fully integrated information system that works for you.**
- **KEY to METALS is entirely globally oriented.** It provides you **with a** unique, multilingual platform.
- **From the thousands of materials from the across the world, you can find a material that you need in a few seconds.** And that is not all...
- **You can get the best of both worlds.** Synergy of the continuously upgrad**ed** on-line database (**KEY to METALS** Web Edition) and the fast **and portable** off-line software (**KEY to METALS Desktop Edition**) saves your time and money.

The **KEY to METALS Desktop Edition** gives you a **superfast search engine**. You can **search thousands of materials in a matter of seconds!**

The modules for *Quick Search* and *Advanced Search* are designed for you to display content of the database quickly and efficiently, and to select the materials that meet your search criteria. You don't have to be a programmer or an experienced computer user to use these modules. All you have to know are the basic keyboard and mouse operations.

You can install **KEY to METALS** Desktop Edition as easily as any Windows application. Installation procedures, which are quite simple, are described in Chapter 2 of this manual.

KEY to METALS also has an intuitive and efficient user interface. Principles of the **KEY to METALS** user interface are explained in Chapter 3.

The basic *Quick Search* module is described in Chapter 4, together with a complete sequence of displaying material properties results.

Advanced Search module is explained in full detail in Chapter 5.

Chapter 6 describes the option *Standard List*.

Chapter 8 provides you a number of real-life **KEY to METALS** search examples.

2 Installation

Minimum requirements for KEY to METALS installation include PC with Intel or AMD CPU, 1 GB of RAM, 5 GB available space on the hard disk (8GB for the installation process), DVD drive and Microsoft Windows Operating System (versions XP/Vista/7).

2.1 Installation procedure

KEY to METALS installation is fairly simple. Please follow this procedure:

- Put the **KEY to METALS** installation DVD in your DVD-ROM drive.
- Installation program starts automatically. Alternatively, you may start the Setup procedure (Setup.exe) from **KEY to METALS** installation DVD.
- First, a window for defining installation location appears. You can accept the default location (recommended), or change it by clicking the <Browse> button.
- Click the <Next> button.
- In the window PROGRAM FOLDER click <Next> button.

Then installation process starts. It takes several minutes, depending on your computer configuration. Note: if your computer doesn't have .NET framework already installed, the installation procedure will take a few minutes more.

When the **KEY to METALS** installation process is finished, the window SETUP COMPLETED appears on your computer. You just have to click the <Finish> button and installation is completed.

After the installation, **KEY to METALS** program group is positioned in the Programs part of your Start menu, within **Key to Metals** prompt.

There is also the **KEY to METALS** icon on your desktop. You can start the **KEY to METALS** program the way you are used to.

Before running **KEY to METALS**, you must insert the **supplied USB flash** drive into a designated port on your machine. This should remain in place at all times whilst using **KEY to METALS**.

Notes:

(1) If you are unable to use the provided USB flash drive, you can click on the “Activate by e-mail” link. You will see your unique Computer ID and you will then need to send it by e-mail to KEY to METALS Customer Support with all other required details (name, company and reason why you cannot use the USB flash drive). KEY to METALS Customer Support will then send you an activation code that you need to enter in the same form in the designated field. After that, your installation will be activated and you will be able to use KEY to METALS without the USB flash drive.

3 User Interface

KEY to METALS Desktop Edition runs under the Microsoft Windows operating system, which enables simple and efficient use of applications for the user.

The KEY to METALS user interface has been designed in such a way that a non-programmer or an inexperienced computer user can use **KEY to METALS,** just knowing the basic keyboard and mouse operations.

When you start **KEY to METALS** the main screen appears from which you choose an option from the main menu tabs and access to certain parts of the application. The options are *Home, SmartComp (optional module), Suppliers and Extended Range* (optional). Home (*Quick Search)* is the default option, that shows up first when the program is launched, as shown in Figure 3-1.

Within each main menu tab you can find a range of further sub menu options to guide you intuitively through the database. In the example in Figure 3-1 it is possible to access *Quick Search (default page), Advanced Search, Standard List, Metallography, and Comparison View.*

User interacts with the application preferably by using the mouse. A selected option is activated by positioning the mouse cursor arrow over the option, and by clicking the left mouse button. In further text this action will be referred to as “mouse click”.

Keyboard is used rarely, except for inputting search fields.

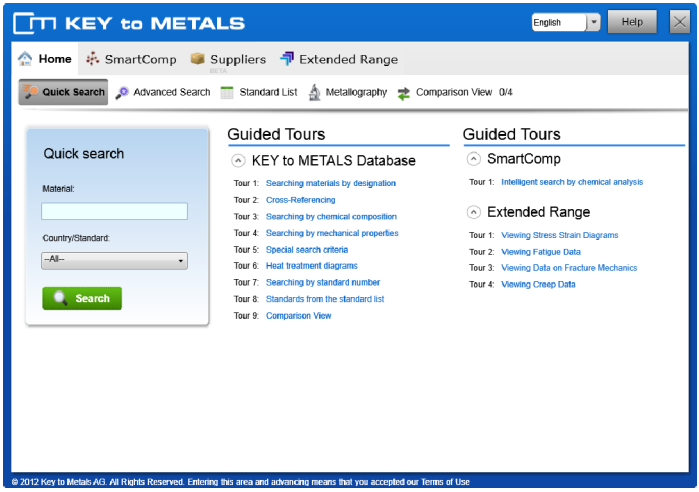

Figure 3-1. The main screen (Quick Search)

3.1 Language selection

Language selection is enabled on the main screen *Quick Search,* by selecting from the popup list in the upper right part of the screen.

Once selected, the same language will be used by **KEY to METALS** until a new selection is made, even after the program is closed.

3.2 Data selection windows

A window is a basic unit of the Windows environment, where the user interacts with the application. The window is an entity that is visually separated from the rest of the screen.

Data selection windows are windows in which you can enter something or change the window content. These windows are *Quick Search*, *Advanced Search, Standard List*, Metallography and Comparison View.

For example, the *Quick Search* window consists of two elements.

The first element is a field (e.g. *Material* in Figure 3-2). It is empty, and you can type-in a complete or partial material designation in that field.

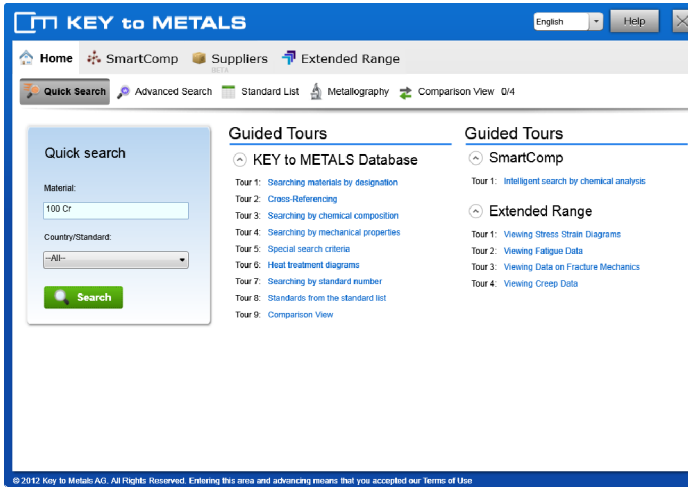

Figure 3-2. Data selection window.

The second element is a dropdown list from which you choose the desired country or standard. The dropdown list is operated in a Windows-standard manner. When a dropdown list is active (being colored differently), you can select data by mouse or by keyboard arrows.

A similar situation occurs when you activate the *Advanced Search* option. By using the same basic elements, you can enter more complex search criteria: standard number, chemical composition and more.

Principles of using *Quick Search, Advanced Search* and *Standard List* screens are described in detail in Chapters 4, 5 and 6, respectively.

3.3 Screen report windows

Screen report windows are all other windows that you meet in the subsequent search steps. They are in general, results of your search actions where information from the database is displayed (Figure 3-3).

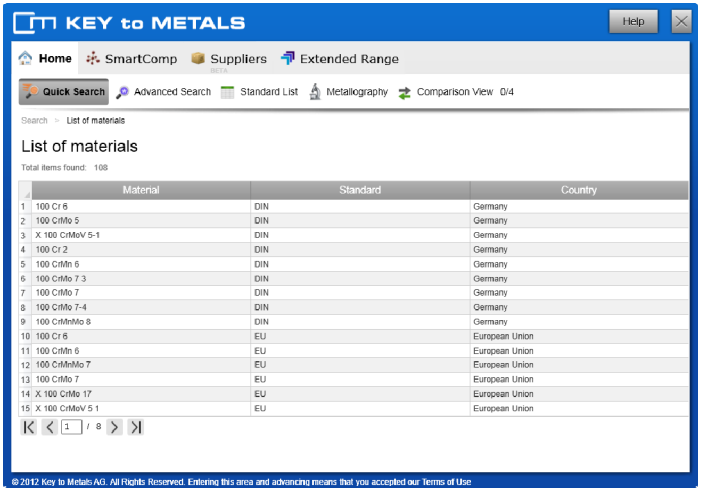
KEY to METALS
Help
Home
SmartComp
Suppliers
Extended Range
Quick Search
Advanced Search
Standard List
Metallography
Comparison View 0/4
Search
List of materials
List of materials
Total items found: 108
Material
Standard
Country
1 100 Cr 6 DIN Germany
2 100 CrMo 5 DIN Germany
3 X 100 CrMoV 5-1 DIN Germany
4 100 Cr 2 DIN Germany
5 100 CrMn 6 DIN Germany
6 100 CrMo 7 3 DIN Germany
7 100 CrMo 7 DIN Germany
8 100 CrMo 7-4 DIN Germany
9 100 CrMnMo 8 DIN Germany
10 100 Cr 6 EU European Union
11 100 CrMn 6 EU European Union
12 100 CrMnMo 7 EU European Union
13 100 CrMo 7 EU European Union
14 X 100 CrMo 17 EU European Union
15 X 100 CrMoV 5 1 EU European Union
1 / 8
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Figure 3-3. Example of screen report window.

Screen report windows inform you about:

- materials that fulfill search criteria
- the standard and subgroup where the material belongs
- mechanical properties
- chemical composition
- cross-references, that is, equivalent materials originating from different countries and standards

You may read more details about the information that can be displayed from the database in Chapter 4 (Sections 4.2, 4.3 and 4.4) and in examples in Chapter 7.

3.4 Printing

When you see a printer icon on the screen, you know that the report can be printed on a printer connected to the computer.

You can print lists of materials that meet given criteria and properties of a selected material. The data contained in the printed report depend on the module from which you print. For instance, in *Quick Search* and *Advanced Search*, you can print the lists of materials that satisfy the search criteria and individual properties of selected material.

You activate the printing process by clicking printer icon within the program. After the standard Print dialog window, a Print Preview window appears. In this window, simple icons are used as in common text processors, such as Microsoft Word. For example, after you click the printer icon within the Print Preview window, the printing process starts and you get the hard copy of the required report.

3.5 Help

When you activate the Help option, you see a screen containing this user manual that facilitates mastering the first steps in using the **KEY to METALS** software.

3.6 Exit

You can exit from **KEY to METALS** anywhere in your program, simply by clicking on standard Windows icon for closing programs, in the upper right corner.

4 Quick Search

Although the **KEY to METALS** database is comprehensive and powerful, searching its content is very simple and fast.

Quick Search is the default option, which always shows up first when the program is launched (Figure 4-1). It is also always accessible within the program through the *Quick Search* tab in the upper left part of the screen in the *Home* main menu tab.

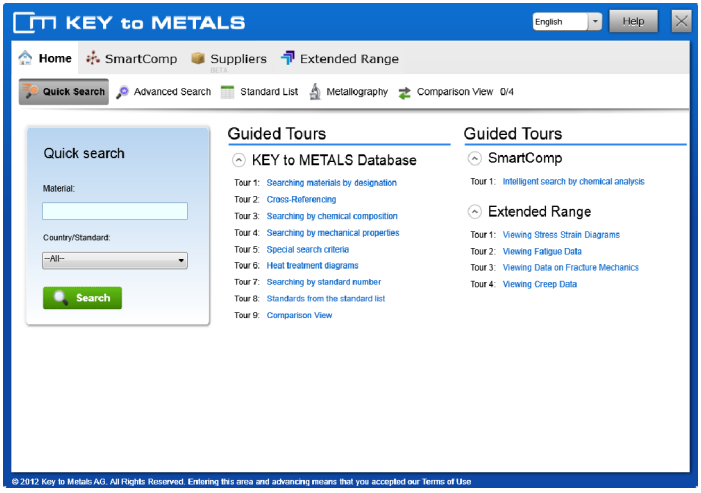

Figure 4-1. Quick Search: searching by material designation and country / standard.

4.1 Search explanation

In the *Quick Search* window you define the search criteria. In the Material field, you can type in a material designation, either a full or part designation.

From the Country / Standard popup, you can select country/standard. You can define one or two search criteria.

By clicking on the Search button, the search begins. Next screen (List of Materials) appears, which displays a table containing all materials from the database that satisfy the given criteria (Figure 4-2).

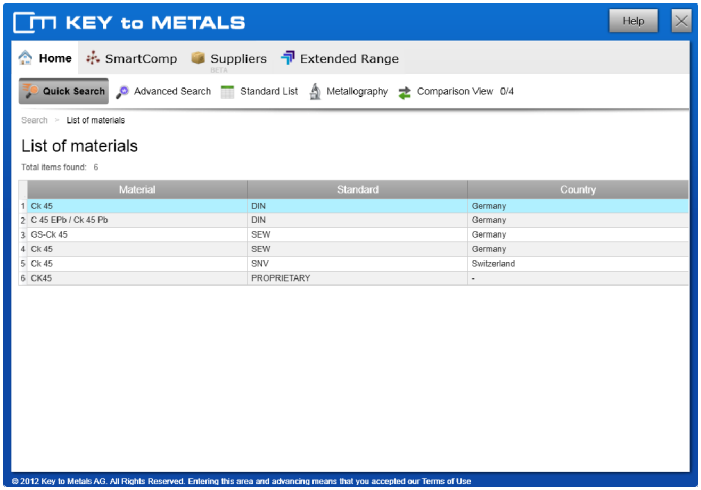

Figure 4-2. List of materials that fulfill the given criteria.

4.2 Viewing material properties

Starting from the resulting list of materials, either obtained by *Quick Search* or by *Advanced Search*, you can review material property details.

To view properties of a material, you first have to click on it. After clicking on the material, a new screen appears -- Subgroup (Figure 4-3). Some materials are defined according to several standards, thereby belonging to more than one subgroup (note: subgroup mostly refers to one standard number); properties defined according to different standards may differ significantly. The majority of the materials in the database belong to only one subgroup.

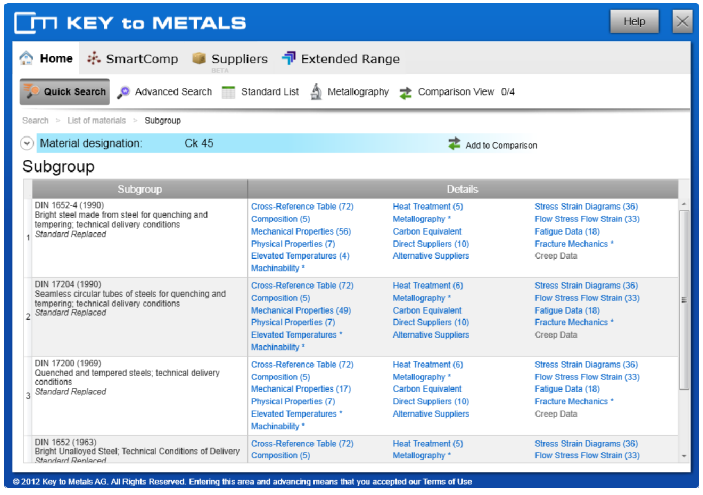

Figure 4-3. Subgroups.

After selecting the subgroup and clicking on the appropriate link, the *Material Properties* screen appears.

The *Material Properties* screens show the most important material properties, such as chemical composition, yield stress, tensile stress,

elongation, impact value, hardness, application and cross-reference table (Figures 4-4 and 4-5).

Here you can view and, optionally, print selected properties (printing is described in Chapter 3).

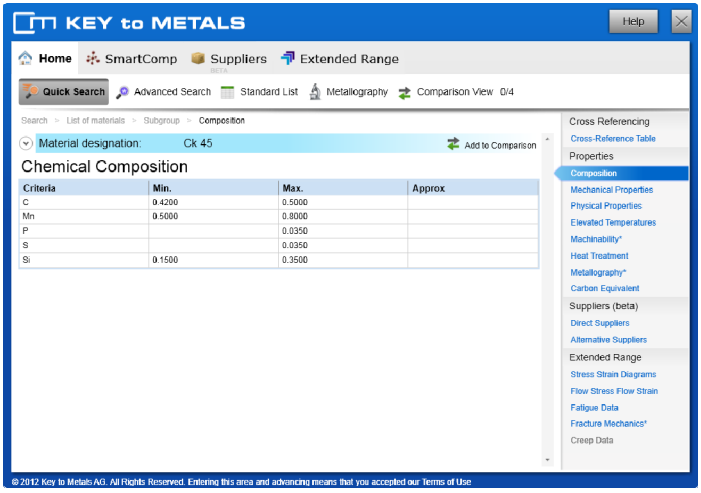

Figure 4-4. Chemical composition.

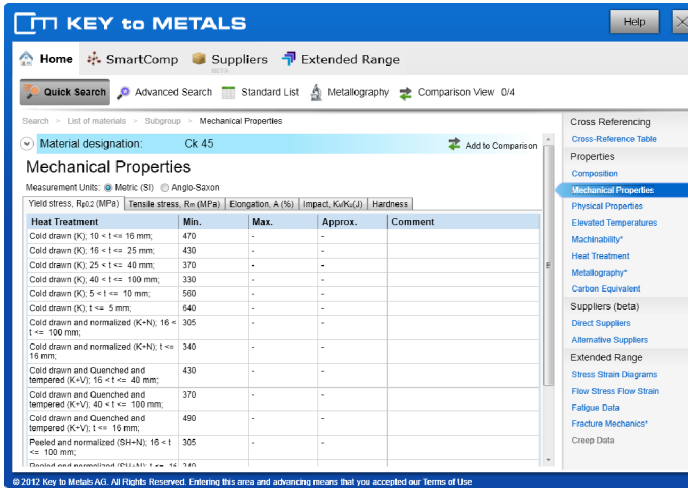
KEY to METALS
Help
Home
SmartComp
Suppliers
Extended Range
Quick Search
Advanced Search
Standard List
Metallography
Comparison View 0/4
Search > List of materials > Subgroup > Mechanical Properties
Material designation: Ck 45
Add to Comparison
Mechanical Properties
Measurement Units: Metric (SI) Anglo-Saxon
Yield stress, Rp0.2 (MPa) | Tensile stress, Rm (MPa) | Elongation, A (%) | Impact, KU/KV(J) | Hardness
Heat Treatment | Min. | Max. | Approx. | Comment
Cold drawn (K); 10 < t <= 16 mm; | 470 | - | -
Cold drawn (K); 16 < t <= 25 mm; | 430 | - | -
Cold drawn (K); 25 < t <= 40 mm; | 370 | - | -
Cold drawn (K); 40 < t <= 100 mm; | 330 | - | -
Cold drawn (K); 5 < t <= 10 mm; | 560 | - | -
Cold drawn (K); t <= 5 mm; | 640 | - | -
Cold drawn and normalized (K+N); 16 < t <= 100 mm; | 305 | - | -
Cold drawn and normalized (K+N); t <= 16 mm; | 340 | - | -
Cold drawn and Quenched and tempered (K+V); 16 < t <= 40 mm; | 430 | - | -
Cold drawn and Quenched and tempered (K+V); 40 < t <= 100 mm; | 370 | - | -
Cold drawn and Quenched and tempered (K+V); t <= 16 mm; | 490 | - | -
Peeled and normalized (SH+N); 16 < t <= 100 mm; | 305 | - | -
Cross Referencing
Cross-Reference Table
Properties
Composition
Mechanical Properties
Physical Properties
Elevated Temperatures
Machinability*
Heat Treatment
Metallography*
Carbon Equivalent
Suppliers (beta)
Direct Suppliers
Alternative Suppliers
Extended Range
Stress Strain Diagrams
Flow Stress Flow Strain
Fatigue Data
Fracture Mechanics*
Creep Data
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Figure 4-5. Mechanical properties.

4.3 Cross-references and SmartCross²™

Cross-referencing, that is finding equivalent materials from different standards worldwide is one of the most important applications of **KEY to METALS**.

To provide you with even better and more precise cross-referencing of alloys from all over the world, KEY to METALS now gives you categorization of equivalents and similarity. This worldwide unique feature enables you to get more candidates for equivalent materials, with the degree of their similarity and a first indication of the reliability of the information source.

Caution: You should be aware that cross-referencing and replacing one material with the other is very delicate and possibly error-prone. Whether materials can be really interchanged highly depends on circumstances in each particular case, like for example application, environment, heat treatment, state of

delivery etc. Therefore, you should consider every recommendation very carefully, only as a possibility, not as a final solution.

KEY to METALS cross-reference tables are accessible through the Subgroup screen, by clicking on the Cross-Reference page (Figure 4-7).

Metal equivalents from around the world are usually grouped on the basis of chemical composition and to some extent on mechanical properties, and recommendations for cross-reference tables often come from Standards Development Organizations (SDOs). Recommendations from SDOs are the major source for cross-reference tables in KEY to METALS as well, but in many cases there are no recommendations for a particular group of alloys or a country.

Therefore, beyond recommendations of SDOs KEY to METALS comprise other sources, implicit similarities and special algorithms, which yield distinctive groups of results as described further.

Tab **All** displays all materials from all cross-reference tables and sources together. Typical examples are dual designations – alpha numerical and numerical – for the same material in Euronorm and some other designation system.

The tab **Identical** includes materials which are defined as identical by Standard Development Organizations (SDOs).

Official are equivalents originally recommended by SDOs, in standards and official reference books published by SDOs. Materials displayed within the tab Identical are not displayed with the tab Official.

The tab **Composition 100%** comprise alloys which have 100% identical chemical composition, but have not been declared as official equivalent by SDOs, hence they cannot be found neither within the tag Identical, nor within the tag Official.

Implicit are equivalents not directly and explicitly defined by SDOs, but in a transitional form, i.e. if B is a recommended equivalent by an SDO to A, and C is recommended by that or another SDO as an equivalent to B, then A becomes an equivalent to C. Materials displayed within the

previous three tabs (Identical, Official and Composition 100%) are not displayed in this tab.

Cross-references that originate from all other sources, such as producers' catalogs, books, brochures, analysis published on the Internet etc, are displayed in the tab **Other Sources**. Nearly all proprietary metals are in this category, with few exceptions catalogued by the UNS. Materials already displayed within the tabs Identical, Official, Composition 100%, and Implicit are not displayed in this tab.

You can directly jump to the properties of an equivalent material from the cross-reference table. To perform this, simply double-click on the selected equivalent material. This way you automatically switch to the properties of the new material.

Besides conventional cross-reference tables, **KEY to METALS** provides you **SmartCross²™**, worldwide unique tool for cross-referencing. **SmartCross²™** is designed to help you find similar materials, especially when classic cross-referencing doesn't yield satisfactory results.

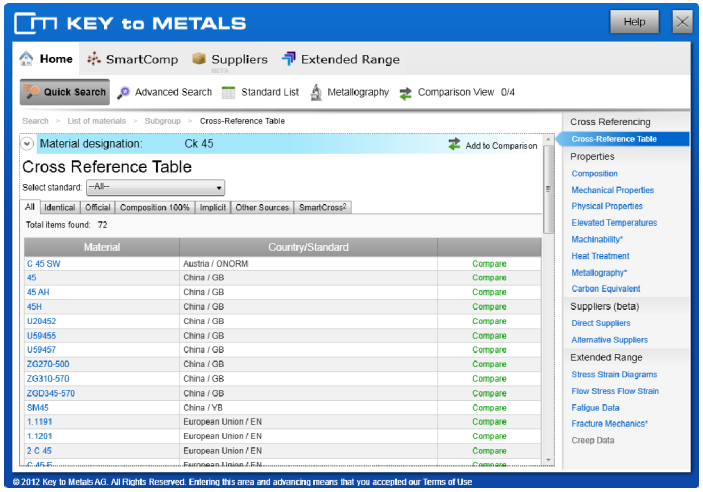

Figure 4-6. Example of cross-reference table (table of equivalent materials).

SmartCross²™ is searching similar materials from the complete **KEY to METALS** Database by comparing chemical compositions and/or mechanical properties. The algorithm is based on Artificial Intelligence (AI) and Fuzzy Logic (FL), and it is designed to use the same general pattern when comparing chemical composition, mechanical properties or a combination of both of two materials as a human expert would do.

You can use **SmartCross²™** simply by clicking on the appropriate tab within the Cross-Reference page. Complete operation is done fully automatically by the program (Figure 4-7).

For a selected material, the algorithm estimates the similarity of its chemical composition/mechanical properties with data of all other materials in the database. Similarity can go from 0 (no similarity) to 1 (the composition is exactly the same). To change the similarity

threshold simply click on the drop down menu to widen or narrow the results list according to specific needs.

Using the special slider mechanism it is possible to specify what property comparison is of most importance, whether it be chemical composition only (slider should be fully to the left position), mechanical properties only (slider should be fully to the right position) or a weighted combination of both chemical composition and mechanical properties (user defined).

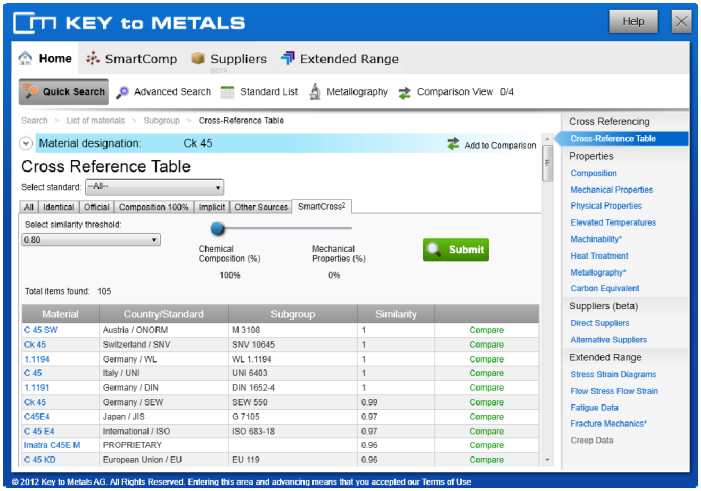
KEY to METALS
Help
Home
SmartComp
Suppliers
Extended Range
Quick Search
Advanced Search
Standard List
Metallography
Comparison View 0/4
Search > List of materials > Subgroup > Cross-Reference Table
Material designation: Ck 45
Add to Comparison
Cross Reference Table
Select standard: --All--
All | Identical | Official | Composition 100% | Implicit | Other Sources | SmartCross²
Select similarity threshold:
0.80
Chemical Composition (%)
100%
Mechanical Properties (%)
0%
Submit
Total items found: 105
Material | Country/Standard | Subgroup | Similarity
C 45 SW | Austria / ONORM | M 3108 | 1 | Compare
Ck 45 | Switzerland / SNV | SNV 10645 | 1 | Compare
1.1194 | Germany / WL | WL 1.1194 | 1 | Compare
C 45 | Italy / UNI | UNI 6403 | 1 | Compare
1.1191 | Germany / DIN | DIN 1652-4 | 1 | Compare
Ck 45 | Germany / SEW | SEW 550 | 0.99 | Compare
C45E4 | Japan / JIS | G 7105 | 0.97 | Compare
C 45 E4 | International / ISO | ISO 683-18 | 0.97 | Compare
Imatra C45E M | PROPRIETARY | | 0.96 | Compare
C 45 KD | European Union / EU | EU 119 | 0.96 | Compare
Cross Referencing
Cross-Reference Table
Properties
Composition
Mechanical Properties
Physical Properties
Elevated Temperatures
Machinability*
Heat Treatment
Metallography*
Carbon Equivalent
Suppliers (beta)
Direct Suppliers
Alternative Suppliers
Extended Range
Stress Strain Diagrams
Flow Stress Flow Strain
Fatigue Data
Fracture Mechanics*
Creep Data
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Figure 4-7. SmartCross^{2}™ results.

By the very nature of AI and FL that are used for all these calculations, the similarity index provided in **SmartCross^{2}™** has no firm meaning, it is a descriptive number, aimed to indicate which alloys the user can consider. It can be generally said that similarities above 0.9 are quite high, but it is definitely required of the user to examine chemical composition and or mechanical properties of all alloys considered in detail and to check the fitness for his or her particular purpose.

Caution given to using cross-reference tables applies as well for using SmartCross^{2TM}. You should consider every recommendation very carefully, only as a possibility, not as a final solution.

4.4 Comparison View

KEY to METALS allows a range of options for comparing materials side by side, providing an efficient and informative tool in the decision making process for the search for similar and equivalent materials.

After the material has been selected it is possible to add it to the Comparison View clipboard by clicking on the Add to comparison link on the Subgroup and Details pages.

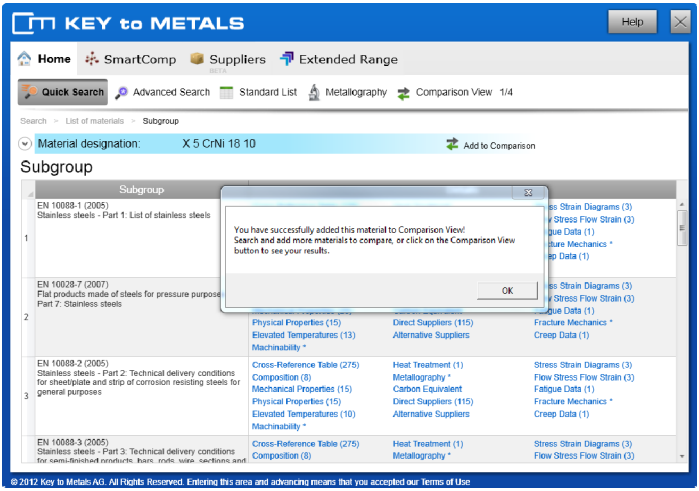
KEY to METALS
Help
Home
SmartComp
Suppliers
Extended Range
Quick Search
Advanced Search
Standard List
Metallography
Comparison View 1/4
Search > List of materials > Subgroup
Material designation: X 5 CrNi 18 10
Add to Comparison
Subgroup
Subgroup
You have successfully added this material to Comparison View!
Search and add more materials to compare, or click on the Comparison View button to see your results.
OK
EN 10088-1 (2005)
Stainless steels - Part 1: List of stainless steels
EN 10028-7 (2007)
Flat products made of steels for pressure purposes - Part 7: Stainless steels
EN 10088-2 (2005)
Stainless steels - Part 2: Technical delivery conditions for sheet/plate and strip of corrosion resisting steels for general purposes
EN 10088-3 (2005)
Stainless steels - Part 3: Technical delivery conditions
Physical Properties (15)
Elevated Temperatures (13)
Machinability *
Direct Suppliers (115)
Alternative Suppliers
Fracture Mechanics *
Creep Data (1)
Cross-Reference Table (275)
Composition (8)
Mechanical Properties (15)
Physical Properties (15)
Elevated Temperatures (10)
Machinability *
Heat Treatment (1)
Metallography *
Carbon Equivalent
Direct Suppliers (115)
Alternative Suppliers
Stress Strain Diagrams (3)
Flow Stress Flow Strain (3)
Fatigue Data (1)
Fracture Mechanics *
Creep Data (1)
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Figure 4-8. Adding the first material for comparison

Through searching the cross reference tables it is then possible to add further materials to the comparison view clipboard by following the step described previously.

It is possible to repeat this process to enable comparison of up to 4 materials at any one time and it is then possible to simply compare chemical composition, mechanical properties and physical properties of the selected materials.

When all selected materials have been added to the clipboard, the full side by side comparison can be made by clicking on the Comparison View button in the sub menu tab.

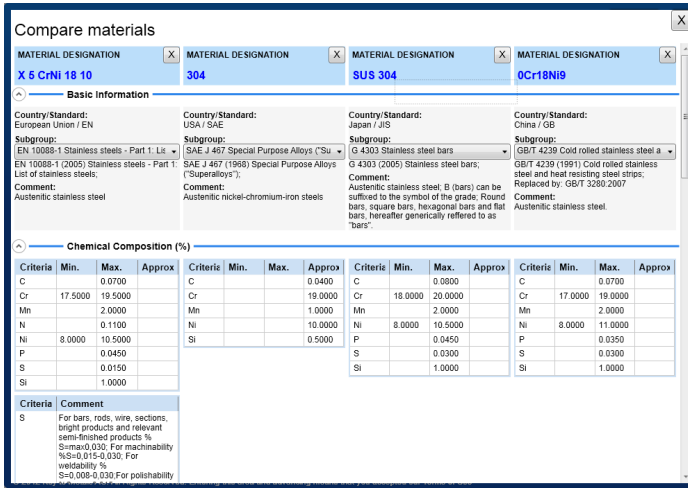

Figure 4-9. Four materials compared side by side

4.5 C equivalent

KEY to METALS calculates Carbon Equivalent (CE) for steel alloys from the Database, by using original algorithm and 10 different formulas. One or more formulas for calculating CE are automatically

selected by the system, depending on the material composition, without need for user's intervention.

Caution: Carbon Equivalent is by its definition an approximation, that is used to roughly indicate weldability of an alloy. Weldability, pre-processing, heat treatments, welding regimes and other parameters for welding need to be defined for each particular case by a specialist.

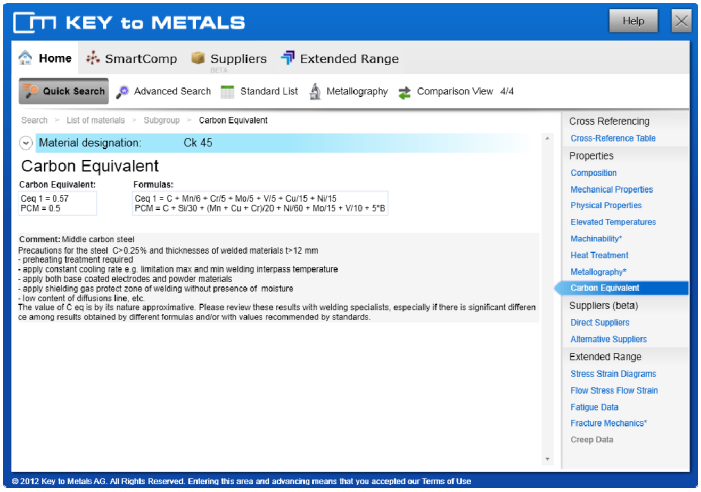
KEY to METALS
Help
Home
SmartComp
Suppliers
Extended Range
Quick Search
Advanced Search
Standard List
Metallography
Comparison View 4/4
Search > List of materials > Subgroup > Carbon Equivalent
Material designation: Ck 45
Carbon Equivalent
Carbon Equivalent:
Ceq 1 = 0.57
PCM = 0.5
Formulas:
Ceq 1 = C + Mn/6 + Cr/5 + Mo/5 + V/5 + Cu/15 + Ni/15
PCM = C + Si/30 + (Mn + Cu + Cr)/20 + Ni/60 + Mo/15 + V/10 + 5*B
Comment: Middle carbon steel
Precautions for the steel C>0.25% and thicknesses of welded materials t>12 mm
- preheating treatment required
- apply constant cooling rate e.g. limitation max and min welding interpass temperature
- apply both base coated electrodes and powder materials
- apply shielding gas protect zone of welding without presence of moisture
- low content of diffusions line, etc.
The value of C eq is by its nature approximative. Please review these results with welding specialists, especially if there is significant differen
ce among results obtained by different formulas and/or with values recommended by standards.
Cross Referencing
Cross-Reference Table
Properties
Composition
Mechanical Properties
Physical Properties
Elevated Temperatures
Machinability*
Heat Treatment
Metallography*
Carbon Equivalent
Suppliers (beta)
Direct Suppliers
Alternative Suppliers
Extended Range
Stress Strain Diagrams
Flow Stress Flow Strain
Fatigue Data
Fracture Mechanics*
Creep Data
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Figure 4-10. C equivalent.

4.6 Physical Properties

The physical properties of metals, such as density, Young modulus, Poisson coefficient, thermal conductivity, and electrical resistivity, depend on many factors ranging from variations in chemical and phase compositions, applied heat treatment and processing, to crystallite

axes direction. The values of physical properties of metals can often depend on the direction in which they are measured in the crystal lattice and hence are not a simply scalar quantity. Therefore, presenting them with a number is generally an approximation.

KEY to METALS physical properties are accessible through the Subgroup screen, by clicking on the Physical Properties link (Figure 4-11).

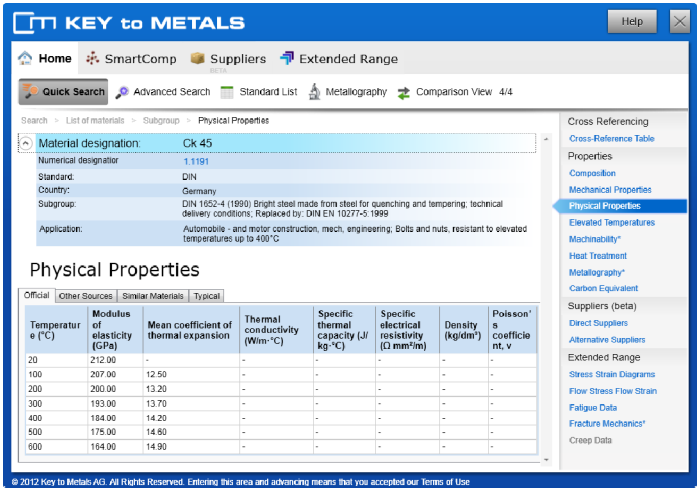


Figure 4-11. Physical properties.

In an effort to provide metallurgists and materials professionals with as much relevant information as possible, KEY to METALS has developed an approach for presenting physical properties in categories that move from more reliable specifics published by SDOs to more generalized information provided by various sources to typical values. This continuum approach has three distinct categories as described below.

Official - For some materials, the physical properties are presented within a material specification published by the corresponding standards development organizations (SDOs). Information published by an SDO is generally reliable, however the values given for physical properties are usually stated as an indication only. Unlike mechanical properties such as tensile and yield stress, that are often mandatory compliance requirements for suppliers, physical properties are usually indicative values for which a much larger range is acceptable, unless otherwise agreed.

Other Sources - The KEY to METALS category Other Sources for physical properties of metals include information from metals industry and academic literature, brochures, producers' catalogs, and analysis and documents published on the Internet. KEY to METALS metallurgists and engineers review this material and make a determination as to its validity. Although information from these sources is usually correct, we view this level of its reliability as lower than recommendations published by SDOs. Consequently, one must conduct an even more rigorous analysis of the properties and associated application for the material.

Similar Materials – Another key functionality of the KEY to METALS cross reference tables, it is possible to find physical properties for materials which are classed as similar to the material of interest. This allows the user to view the physical properties of other materials which are directly connected to the specified material through the cross reference table functionality. Displayed next to each similar material is the defined equivalency category and a compare link which allows the user to make quick and simple comparisons in material selection.

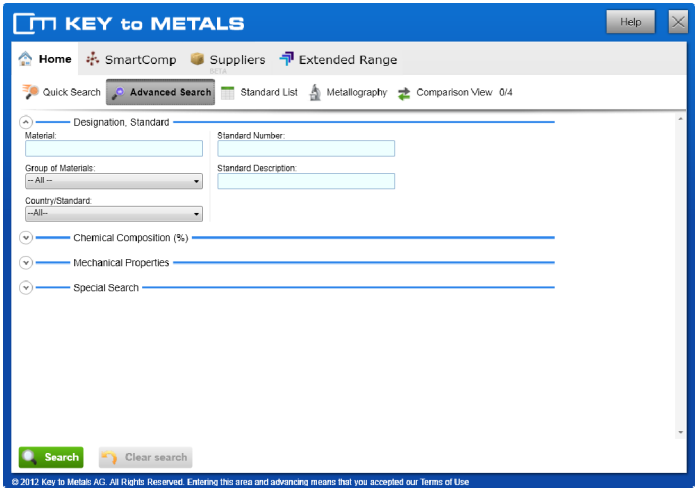
Typical - Based on metallurgical expertise, statistical applications, and analysis of literature, KEY to METALS provides typical properties values for various groups of metals, which are grouped according to metallurgical and physical similarity. These Typical Values are by nature an approximation and can be used only as an initial starting point for calculations, but not as a final value.

5 Advanced Search

In the *Advanced Search* module, you can search materials by designation, countries/standards, group of material, standard number, standard description, chemical composition, mechanical properties or any combination of these criteria.

In any search mode you will get the desired results quickly. The following sections will explain each search option in full detail.

Advanced Search is also activated from the main screen. After you select *Advanced Search*, a window appears where you define your search criteria (Figure 5-1).



5-1. Advanced Search: Search panels

Criteria are grouped in several panels that can be expanded and collapsed.

In the *Designation, Standard* panel you can define searching by material (designation), country/standard, standard number and standard description (Figure 5-2). You can select all available parameters in all panels, or some of them.

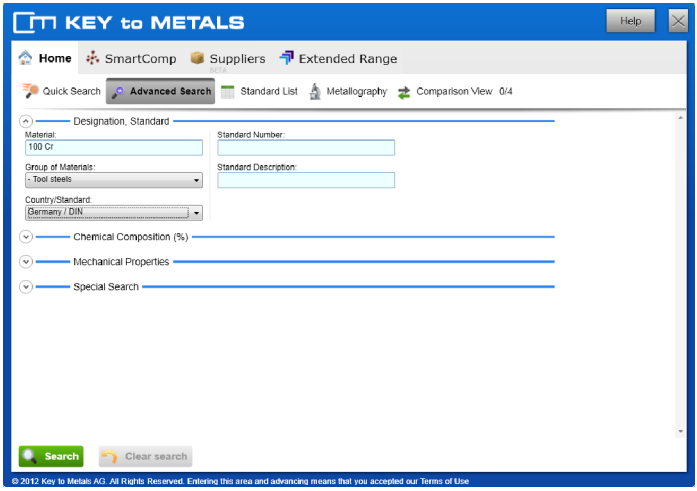


Figure 5-2. Advanced Search: by designation, country/standard and group

The *Chemical Composition* panel consists of empty tables in which you define search criteria by entering values of properties (Figure 5-4).

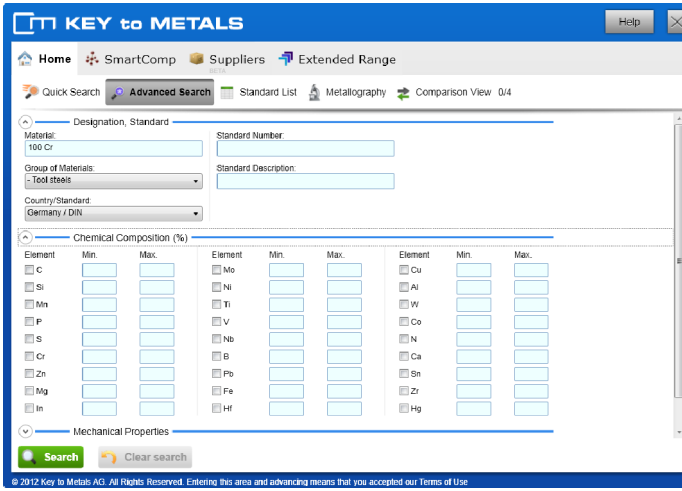


Figure 5-3. Advanced Search: by chemical composition.

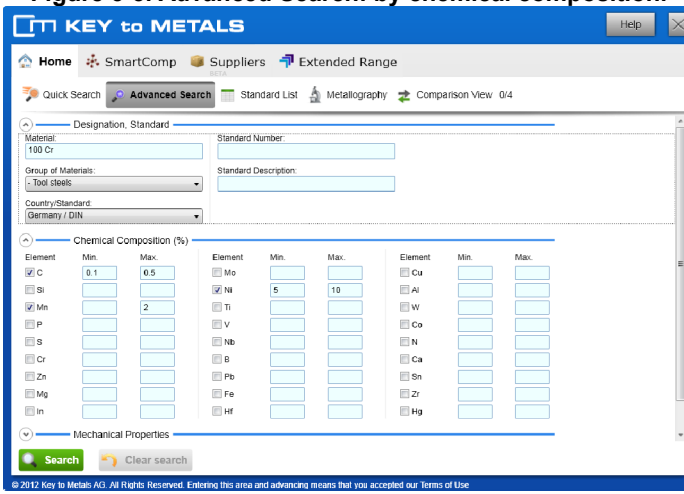


Figure 5-4. Advanced Search: by chemical composition.

The *Mechanical Properties* panel allows for entering desired values for yield stress, tensile stress, elongation, and impact value (Figure 5-5).

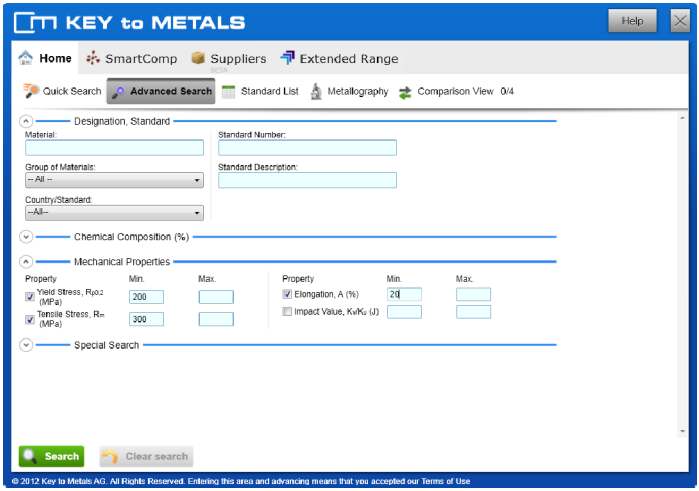


Figure 5-5. Advanced Search: searching by mechanical properties.

Moreover, you can specify properties at elevated temperatures, heat treatment diagrams, physical properties and magnetic properties.

KEY to METALS database contains special data for yield stress, tensile stress, elongation, impact and hardness at elevated temperatures. If you want only materials with this data to be included into the *Advanced Search* results, check the corresponding box within *Special Search* panel (Figure 5-6).

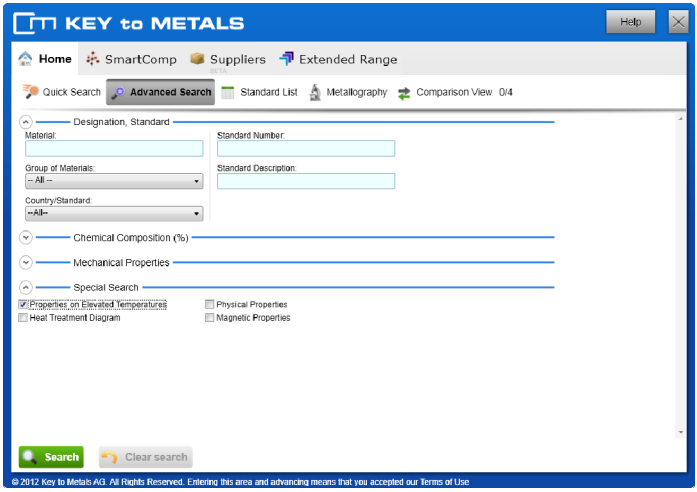


Figure 5-6. Advanced Search: searching by special properties.

You can simultaneously specify the group, the mechanical properties, and the chemical composition. In that case your request becomes more specific and you obtain a shorter list of materials.

When you click on the Search button, search is being performed and the *List of Materials* screen appears. The search result is a list of materials that meet a specified criterion.

As described in Chapter 4, from that list a material can be selected, and finally, the table shows its properties.

6 Standard List

Standards List is a collection of different metallurgical standards and is continuously updated. After clicking on the *Standard List* icon, search criteria can be entered (standard, subgroup, ICS number or a word from a description), as shown in the Figure 6-1.

When you click on the Search button, a search is being performed and the *List of Standards* screen appears (Figure 6-2). The search result is a list of individual standards that meet the specified criteria.

After clicking on the material number, a list of materials defined according to the selected individual standard is shown (Figure 6-3).

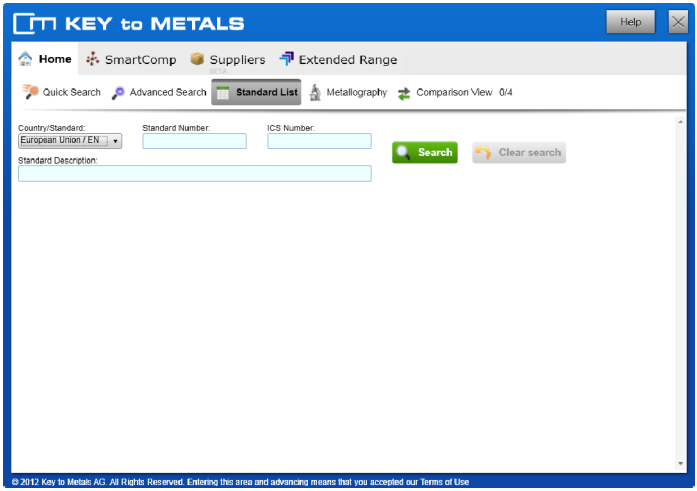


Figure 6-1. Standard List search

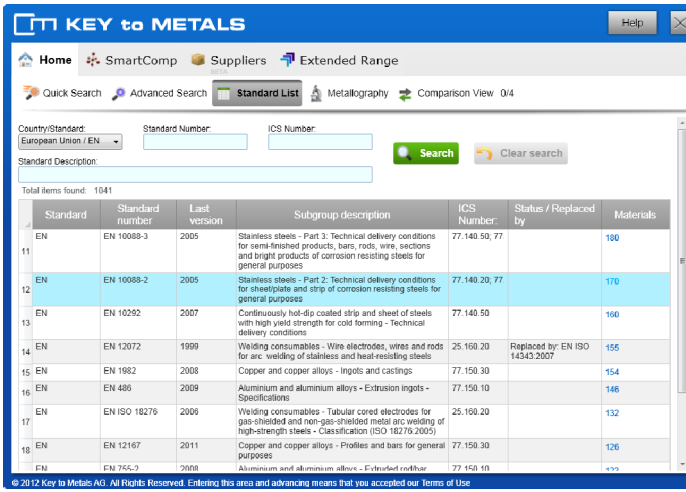

KEY to METALS
Help
Home
SmartComp
Suppliers
Extended Range
Quick Search
Advanced Search
Standard List
Metallography
Comparison View 0/4
Country/Standard:
European Union / EN
Standard Number:
ICS Number:
Search
Clear search
Standard Description:
Total items found: 1041
Standard
Standard number
Last version
Subgroup description
ICS Number:
Status / Replaced by
Materials
11 EN EN 10088-3 2005 Stainless steels - Part 3: Technical delivery conditions for semi-finished products, bars, rods, wire, sections and bright products of corrosion resisting steels for general purposes 77.140.50; 77 180
12 EN EN 10088-2 2005 Stainless steels - Part 2: Technical delivery conditions for sheet/plate and strip of corrosion resisting steels for general purposes 77.140.20; 77 170
13 EN EN 10292 2007 Continuously hot-dip coated strip and sheet of steels with high yield strength for cold forming - Technical delivery conditions 77.140.50 160
14 EN EN 12072 1999 Welding consumables - Wire electrodes, wires and rods for arc welding of stainless and heat-resisting steels 25.160.20 Replaced by: EN ISO 14343:2007 155
15 EN EN 1982 2008 Copper and copper alloys - Ingots and castings 77.150.30 154
16 EN EN 486 2009 Aluminium and aluminium alloys - Extrusion ingots - Specifications 77.150.10 146
17 EN EN ISO 18276 2006 Welding consumables - Tubular cored electrodes for gas-shielded and non-gas-shielded metal arc welding of high-strength steels - Classification (ISO 18276:2005) 25.160.20 132
18 EN EN 12167 2011 Copper and copper alloys - Profiles and bars for general purposes 77.150.30 126
EN EN 755-2 2008 Aluminium and aluminium alloys - Extruded rod/bar 77.150.10 122
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Figure 6-2. List of Standards

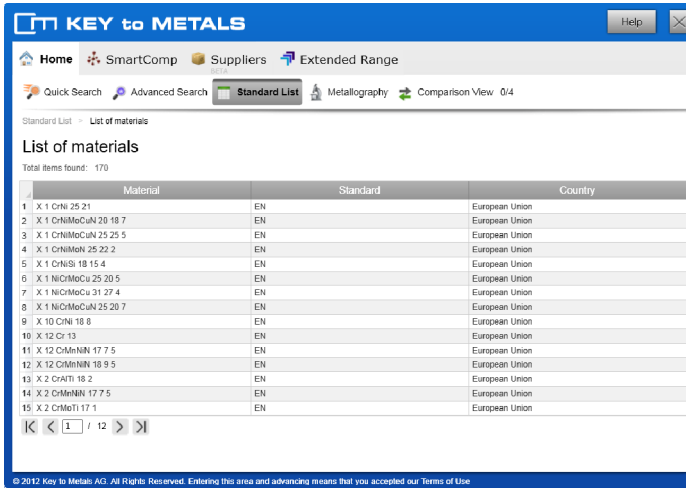
KEY to METALS
Help
Home
SmartComp
Suppliers
Extended Range
Quick Search
Advanced Search
Standard List
Metallography
Comparison View 0/4
Standard List > List of materials
List of materials
Total items found: 170
Material
Standard
Country
1 X 1 CrNi 25 21 EN European Union
2 X 1 CrNiMoCuN 20 18 7 EN European Union
3 X 1 CrNiMoCuN 25 25 5 EN European Union
4 X 1 CrNiMoN 25 22 2 EN European Union
5 X 1 CrNiSi 18 15 4 EN European Union
6 X 1 NiCrMoCu 25 20 5 EN European Union
7 X 1 NiCrMoCu 31 27 4 EN European Union
8 X 1 NiCrMoCuN 25 20 7 EN European Union
9 X 10 CrNi 18 8 EN European Union
10 X 12 Cr 13 EN European Union
11 X 12 CrMnNiN 17 7 5 EN European Union
12 X 12 CrMnNiN 18 9 5 EN European Union
13 X 2 CrAlTi 18 2 EN European Union
14 X 2 CrMnNiN 17 7 5 EN European Union
15 X 2 CrMoTi 17 1 EN European Union
1 / 12
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Figure 6-3. Materials defined within one individual standard.

7 Optional Modules

Optional modules are add-on modules to the standard KEY to METALS package. At the moment, there are three add-on modules covering a range of different data and functions.

Optional modules are available through the main tab menu and so if these have not been selected at point of purchase, they will not be visible in the menu (excluding Key to Suppliers, which is free for all users).

7.1 Extended Range

Extended Range is an add-on for advanced property information including stress strain curves, fatigue data, fracture mechanics and creep data.

Stress-strain curves: Unique collection of stress-strain curves for calculations in the plastic range of thousands of materials, heat treatments and working temperatures. Both true and engineering stress curves are given for various strain rates where applicable.

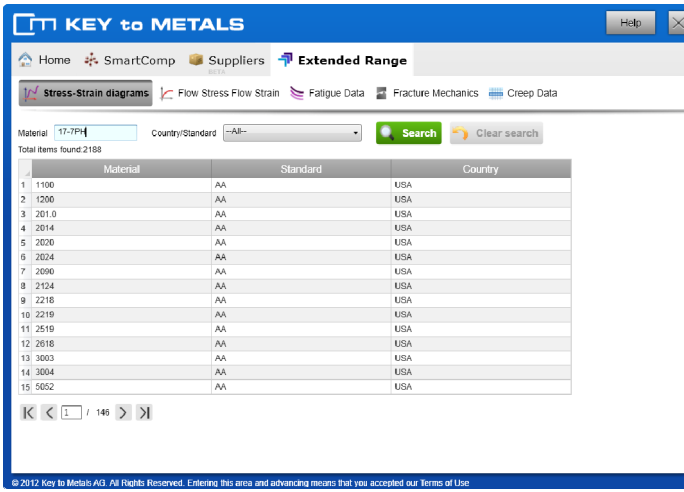

Figure 7-1. Stress-strain – search criteria

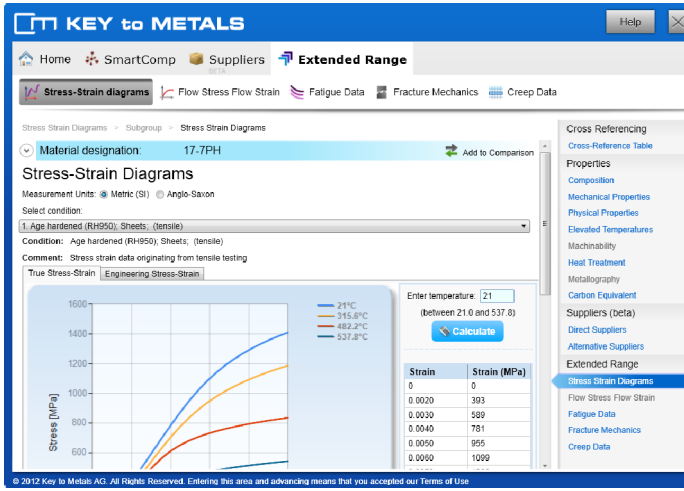

Figure 7-2. Stress-strain – result screen

Fatigue: The largest database of strain life and stress life parameters for various heat treatments and loading conditions. Monotonic properties are included for reference along with statistical parameters and estimates where applicable.

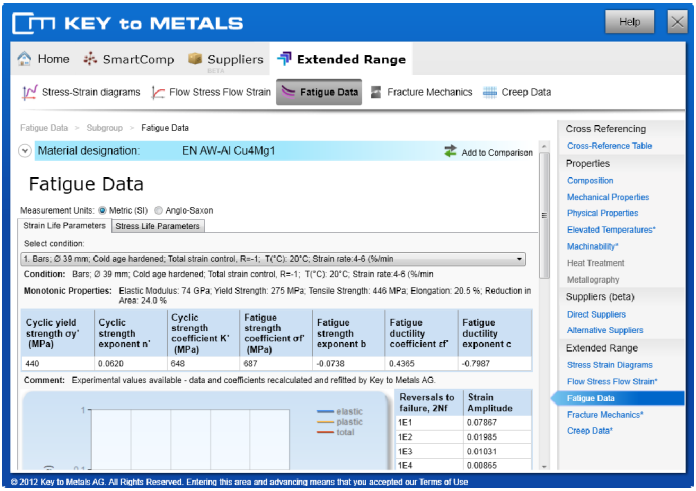

Figure 7-3. Fatigue

Fracture mechanics: K1C, KC, crack growth and Paris law parameters are presented, with the corresponding graph of crack growth. Monotonic properties are included in conjunction with estimates of missing parameters based on monotonic properties when applicable.

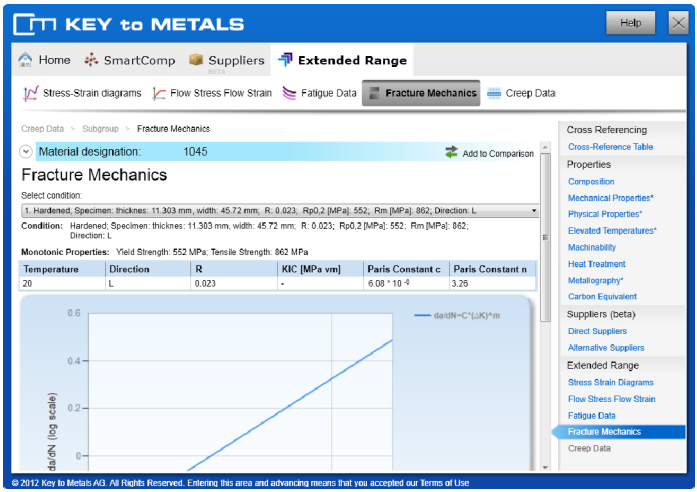

Figure 7-4. Fracture mechanics

Creep data: Yield stress and creep rupture strength at different temperatures are displayed along with the calculation of Larsen-Miller parameter and remaining life of the component.

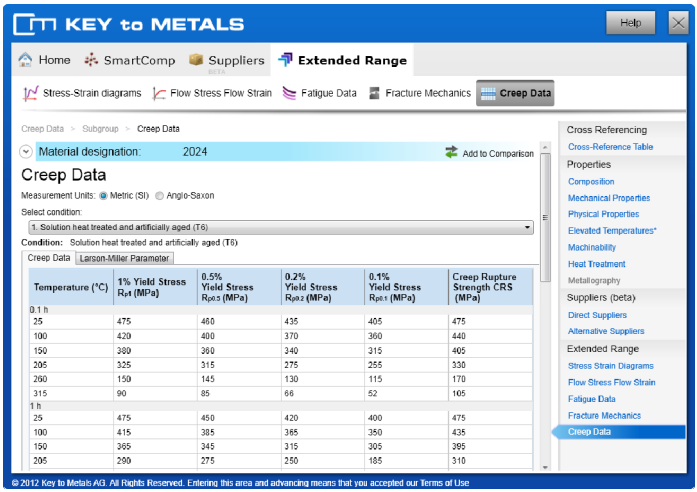

Figure 7-5. Creep data

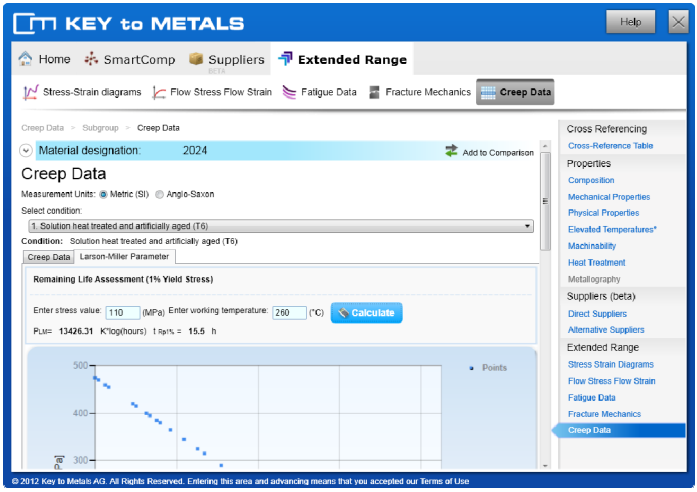

Figure 7-6. Larson-Miller Parameter

7.2 SmartComp

SmartComp is an add-on tool for intelligent search by chemical analysis. SmartComp is the worldwide unique program which will resolve the most complex identification in 3 simple steps, in less than a minute. The SmartComp module is split into 2 modes: Standard Mode and Expert Mode.

Standard Mode

Step 1. Enter analysis as you received it from the measurement instrument, from metallurgical lab or from documentation.

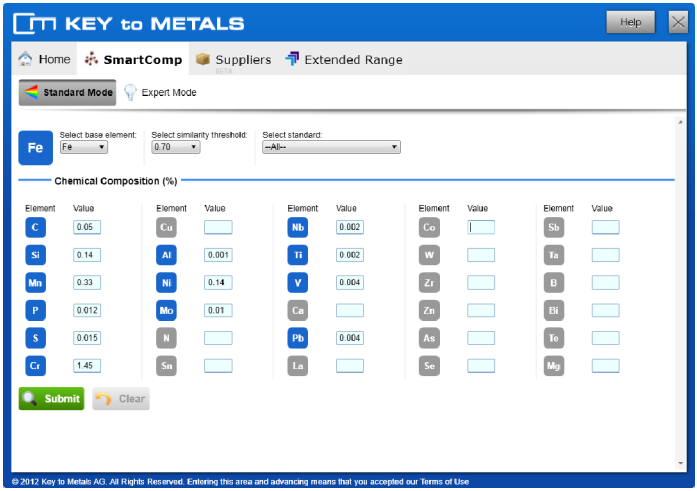
KEY to METALS
Help
Home
SmartComp
Suppliers
Extended Range
Standard Mode
Expert Mode
Fe
Select base element:
Fe
Select similarity threshold:
0.70
Select standard:
--All--
Chemical Composition (%)
Element Value Element Value Element Value Element Value Element Value
C 0.05 Cu Nb 0.002 Co Sb
Si 0.14 Al 0.001 Ti 0.002 W Ta
Mn 0.33 Ni 0.14 V 0.004 Zr B
P 0.012 Mo 0.01 Ca Zn Bi
S 0.015 N Pb 0.004 As Te
Cr 1.45 Sn La Se Mg
Submit
Clear
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Figure 7-7. SmartComp - step 1

Step 2. By using original expert reasoning module and patented SmartMetals technology, based on fuzzy sets and metallurgical expertise, SmartComp distinguishes important composition variations from the noise and trap elements and provides you with a list of possible matches, prioritized by similarity factors.

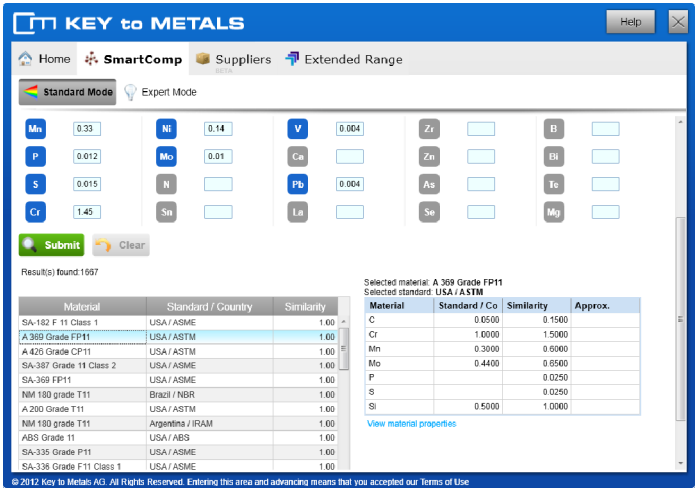

Figure 7-8. SmartComp - step 2

Step 3. Using the lookup feature and hotlinks to the KEY to METALS Database you can click alloys from the list to go directly to the KEY to METALS Database to view detailed material properties.

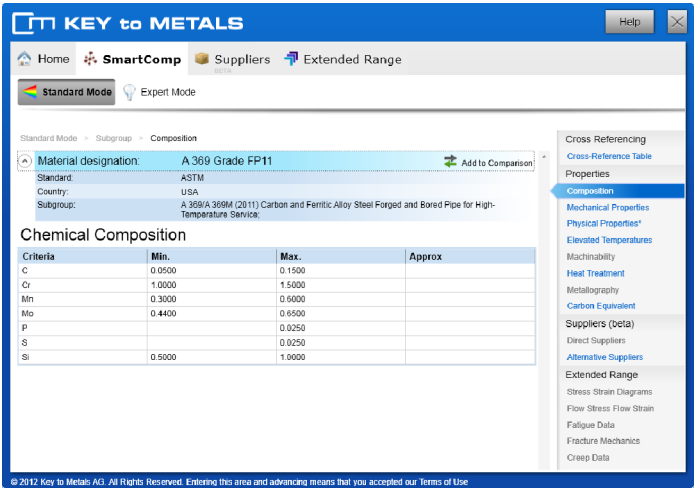

Figure 7-9. SmartComp - step 3

Expert Mode

Designed for expert users, the expert mode gives the user a possibility to change the relative importance of alloying elements in the analysis.

Step 1. Enter analysis as you received it from the measurement instrument, from metallurgical lab or from documentation.

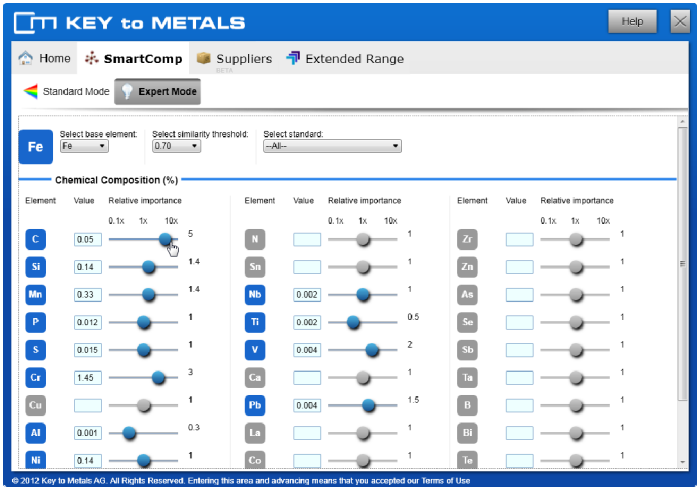

Figure 7-10 SmartComp Expert Mode – step 1

Step 2. Depending on requirements, the unique slider functionality can be used to put more or less emphasis on a specific element to help further tailor the results list.

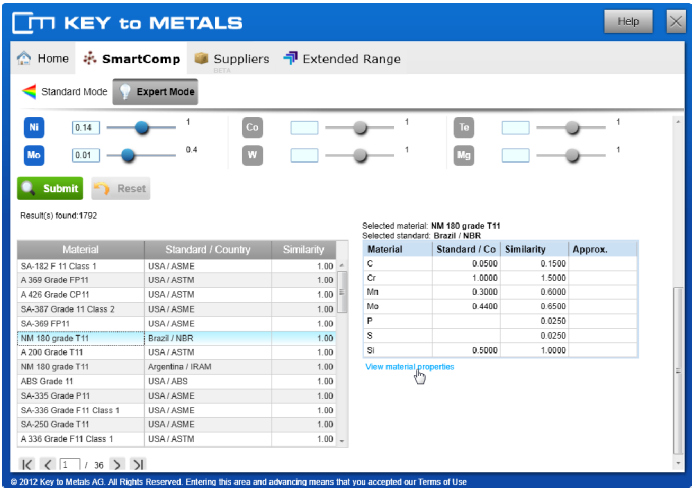

Figure 7-11 SmartComp Expert Mode – step 2

Step 3. Using the lookup feature and hotlinks to the KEY to METALS Database you can click alloys from the list to go directly to the KEY to METALS Database to view detailed material properties.

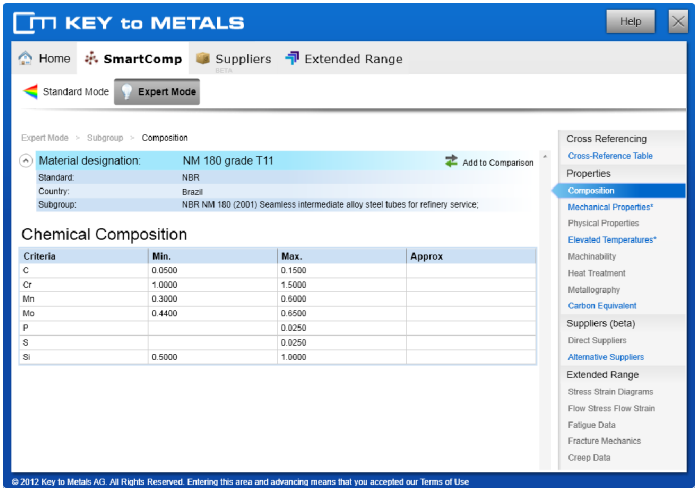

Figure 7-12 SmartComp Expert Mode – step 3

7.3 Key to Suppliers

Key to Suppliers in synergy with KEY to METALS gives you precise relations between material specifications and suppliers from all over the world. This module is free of charge for all Desktop Edition users.

Finding suppliers directly: Browse, search and quickly find metal suppliers from all over the world. Suppliers and their materials are precisely related with designations and standards, using the database and integrated into the KEY to METALS, with a simple point-and-click interface.

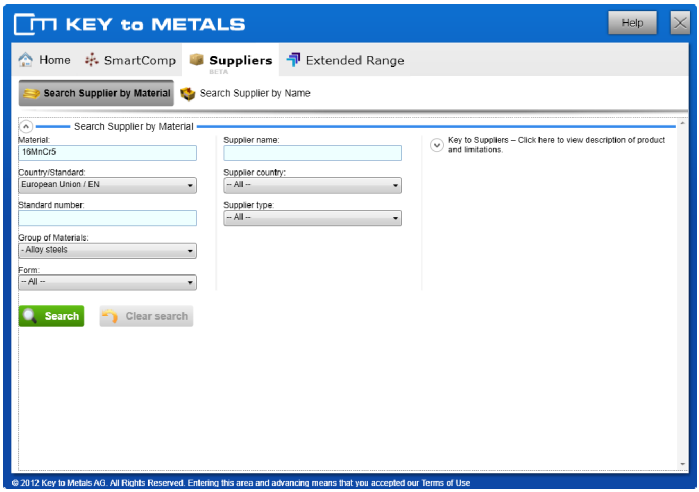

Figure 7-13. Search Supplier by Material – search screen

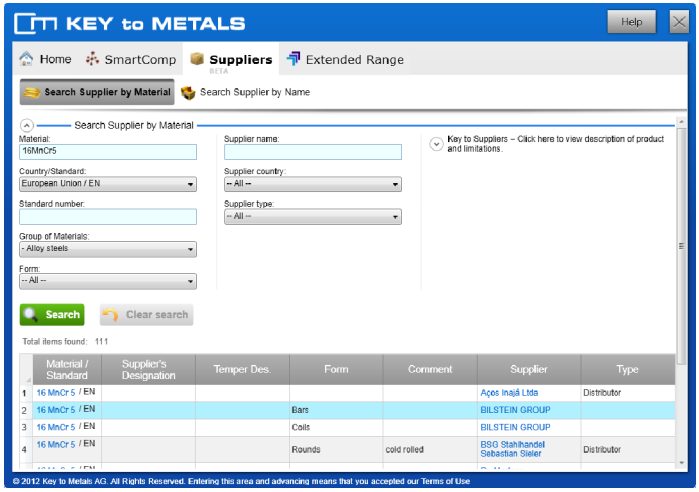

Figure 7-14. Search Supplier by Material – result screen

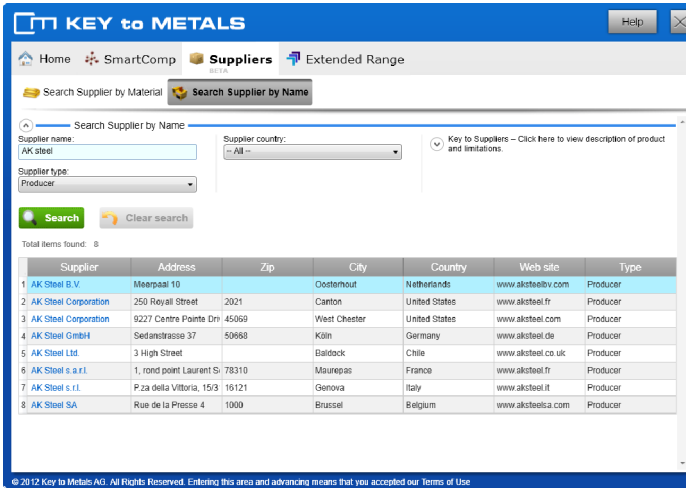
KEY to METALS
Help
Home
SmartComp
Suppliers
BETA
Extended Range
Search Supplier by Material
Search Supplier by Name
Search Supplier by Name
Supplier name:
AK steel
Supplier country:
-- All --
Key to Suppliers – Click here to view description of product and limitations.
Supplier type:
Producer
Search
Clear search
Total items found: 8
Supplier
Address
Zip
City
Country
Web site
Type
1 AK Steel B.V. Meerpaal 10 Oosterhout Netherlands www.aksteelbv.com Producer
2 AK Steel Corporation 250 Royall Street 2021 Canton United States www.aksteel.fr Producer
3 AK Steel Corporation 9227 Centre Pointe Dri 45069 West Chester United States www.aksteel.com Producer
4 AK Steel GmbH Sedanstrasse 37 50668 Köln Germany www.aksteel.de Producer
5 AK Steel Ltd. 3 High Street Baldock Chile www.aksteel.co.uk Producer
6 AK Steel s.a.r.l. 1, rond point Laurent Sc 78310 Maurepas France www.aksteel.fr Producer
7 AK Steel s.r.l. P.za della Vittoria, 15/3 16121 Genova Italy www.aksteel.it Producer
8 AK Steel SA Rue de la Presse 4 1000 Brussel Belgium www.aksteelsa.com Producer
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Figure 7-15. Search Supplier by Name – search screen

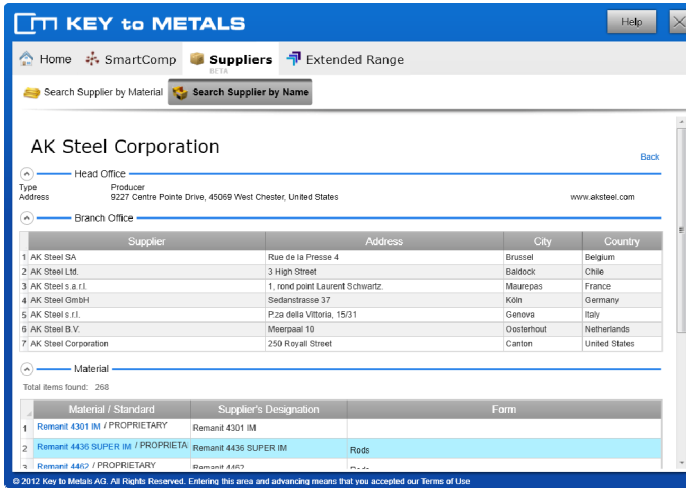
KEY to METALS
Help
Home
SmartComp
Suppliers
BETA
Extended Range
Search Supplier by Material
Search Supplier by Name
AK Steel Corporation
Back
Head Office
Type Producer
Address 9227 Centre Pointe Drive, 45069 West Chester, United States www.aksteel.com
Branch Office
Supplier
Address
City
Country
1 AK Steel SA Rue de la Presse 4 Brussel Belgium
2 AK Steel Ltd. 3 High Street Baldock Chile
3 AK Steel s.a.r.l. 1, rond point Laurent Schwartz. Maurepas France
4 AK Steel GmbH Sedanstrasse 37 Köln Germany
5 AK Steel s.r.l. P.za della Vittoria, 15/31 Genova Italy
6 AK Steel B.V. Meerpaal 10 Oosterhout Netherlands
7 AK Steel Corporation 250 Royall Street Canton United States
Material
Total items found: 268
Material / Standard
Supplier's Designation
Form
1 Remanit 4301 IM / PROPRIETARY Remanit 4301 IM
2 Remanit 4436 SUPER IM / PROPRIETA Remanit 4436 SUPER IM Rods
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Figure 7-16. Search Supplier by Name – result screen

8 KEY to METALS Usage Examples

Example 1

I am an engineer and I forgot the precise designation of a steel material. I remember that the material is an Italian steel and that its designation contains NiCrMo. Can **KEY to METALS** help me find my material designation?

Of course. Use *Quick Search* within the main window. Enter the part of the designation, **NiCrMo** (Figure 8-1), and select the required country, that is **Italy**. Click the Search button to initiate *Quick Search* and to see the search results (Figure 8-2). Identify your material from the list of materials shown.

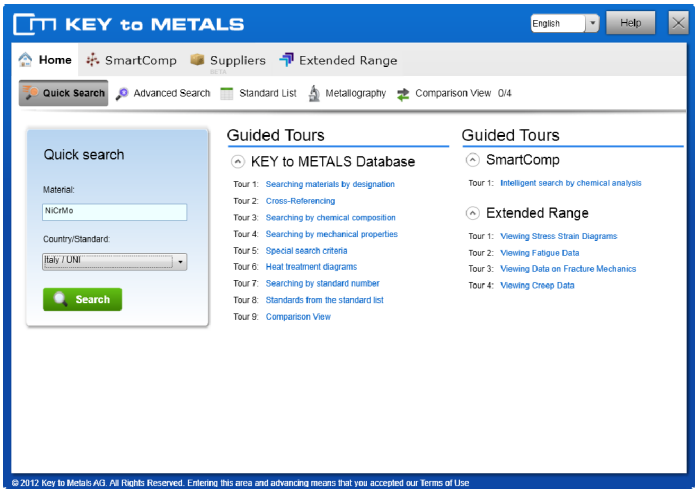

Figure 8-1

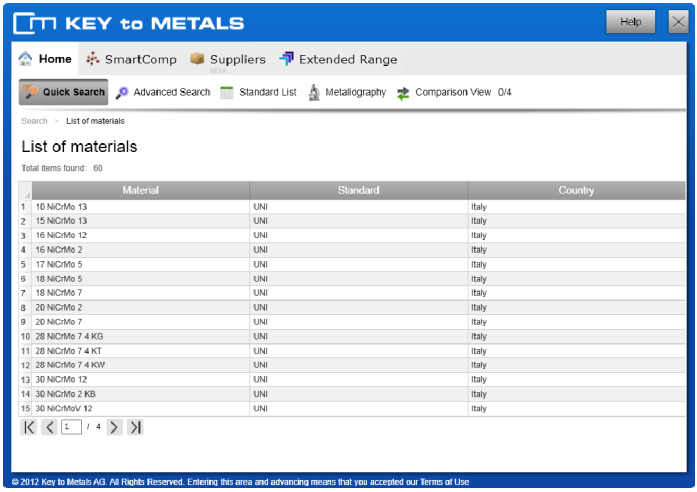
KEY to METALS
Help
Home
SmartComp
Suppliers
Extended Range
Quick Search
Advanced Search
Standard List
Metallography
Comparison View 0/4
Search > List of materials
List of materials
Total items found: 60
Material
Standard
Country
1 10 NiCrMo 13 UNI Italy
2 15 NiCrMo 13 UNI Italy
3 16 NiCrMo 12 UNI Italy
4 16 NiCrMo 2 UNI Italy
5 17 NiCrMo 5 UNI Italy
6 18 NiCrMo 5 UNI Italy
7 18 NiCrMo 7 UNI Italy
8 20 NiCrMo 2 UNI Italy
9 20 NiCrMo 7 UNI Italy
10 28 NiCrMo 7 4 KG UNI Italy
11 28 NiCrMo 7 4 KT UNI Italy
12 28 NiCrMo 7 4 KW UNI Italy
13 30 NiCrMo 12 UNI Italy
14 30 NiCrMo 2 KB UNI Italy
15 30 NiCrMoV 12 UNI Italy
1 / 4
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Figure 8-2

Example 2

Currently, I am concerned with the design of a pressure vessel. I need the DIN 16 Mo 3 steel but it is not available in my country. Can **KEY to METALS** find a replacement material for me?

Yes, simply by using Cross reference tables. Use *Quick Search* within the main window. Enter the designation **16 Mo 3** in the Material field, and choose **Germany/DIN** in the *Country/Standard* field (Figure 8-3). Click the Search button to initiate Quick Search. Click on the material name and go to Subgroup page window. Next, click *Cross-Reference Table*, and browse the list of equivalent steels (Figure 8-4). Optionally, you can select a material from the list and display its properties.

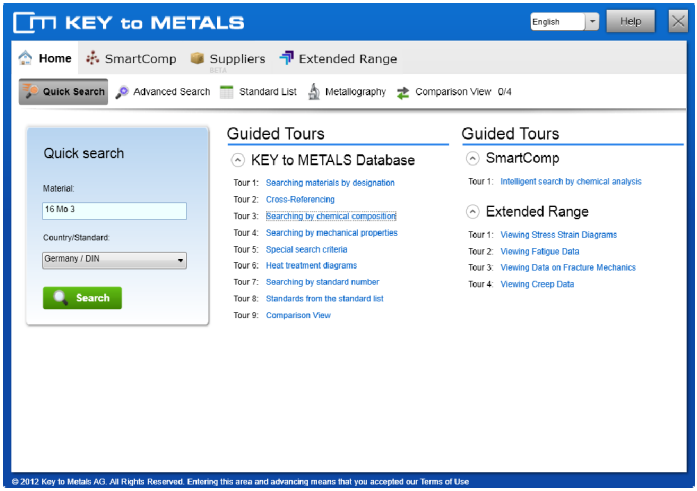

Figure 8-3

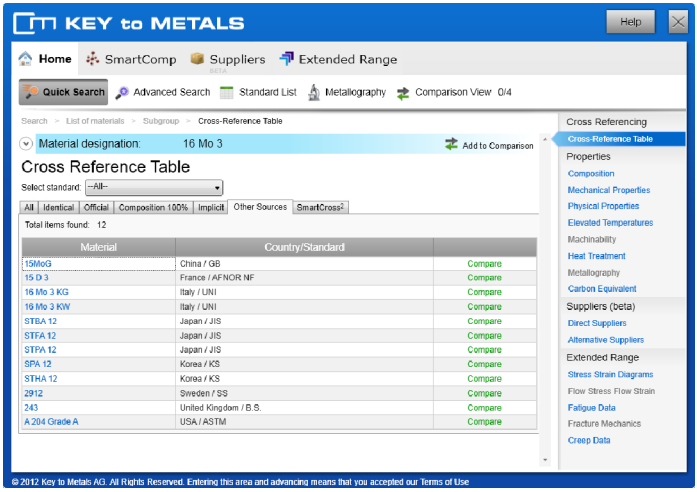
KEY to METALS
Help
Home
SmartComp
Suppliers
Extended Range
Quick Search
Advanced Search
Standard List
Metallography
Comparison View 0/4
Search > List of materials > Subgroup > Cross-Reference Table
Material designation: 16 Mo 3
Add to Comparison
Cross Reference Table
Select standard: --All--
All | Identical | Official | Composition 100% | Implicit | Other Sources | SmartCross²
Total items found: 12
Material
Country/Standard
15MoG China / GB Compare
15 Di 3 France / AFNOR NF Compare
16 Mo 3 KG Italy / UNI Compare
16 Mo 3 KW Italy / UNI Compare
STBA 12 Japan / JIS Compare
STFA 12 Japan / JIS Compare
STPA 12 Japan / JIS Compare
SPA 12 Korea / KS Compare
STHA 12 Korea / KS Compare
2912 Sweden / SS Compare
243 United Kingdom / B.S. Compare
A 204 Grade A USA / ASTM Compare
Cross Referencing
Cross-Reference Table
Properties
Composition
Mechanical Properties
Physical Properties
Elevated Temperatures
Machinability
Heat Treatment
Metallography
Carbon Equivalent
Suppliers (beta)
Direct Suppliers
Alternative Suppliers
Extended Range
Stress Strain Diagrams
Flow Stress Flow Strain
Fatigue Data
Fracture Mechanics
Creep Data
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Figure 8-4

Example 3

Currently, I am concerned with the sourcing of cold finished rods and bars. I need the DIN AlMg2Mn0,3 alloy but it is not available in my country. Can **KEY to METALS** find a replacement material for me?

Yes, simply by using Cross reference tables. Use *Quick Search* within the main window. Enter the designation **AlMg2Mn0,3** in the Material field, and choose **Germany/DIN** from the Country/Standard popup (Figure 8-5). Click the Search button to initiate *Quick Search*. Click on the material to go to Subgroup page. Next, click *Cross-Reference Table*, and browse the list of equivalent alloys (Figure 8-6). Optionally, you can select a material from the list and display its properties.

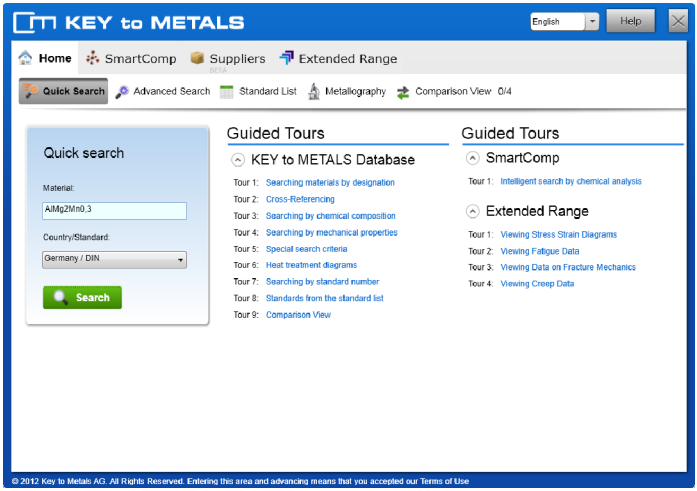

Figure 8-5

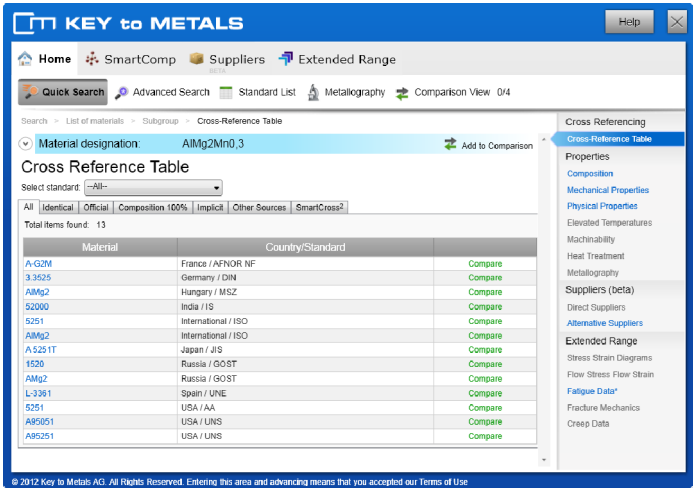
KEY to METALS
Help
Home
SmartComp
Suppliers
Extended Range
Quick Search
Advanced Search
Standard List
Metallography
Comparison View 0/4
Search > List of materials > Subgroup > Cross-Reference Table
Material designation: AlMg2Mn0,3
Add to Comparison
Cross Reference Table
Select standard: --All--
All | Identical | Official | Composition 100% | Implicit | Other Sources | SmartCross²
Total items found: 13
Material
Country/Standard
A-G2M France / AFNOR NF Compare
3.3525 Germany / DIN Compare
AlMg2 Hungary / MSZ Compare
52000 India / IS Compare
5251 International / ISO Compare
AlMg2 International / ISO Compare
A 5251T Japan / JIS Compare
1520 Russia / GOST Compare
AMg2 Russia / GOST Compare
L-3361 Spain / UNE Compare
5251 USA / AA Compare
A95051 USA / UNS Compare
A95251 USA / UNS Compare
Cross Referencing
Cross-Reference Table
Properties
Composition
Mechanical Properties
Physical Properties
Elevated Temperatures
Machinability
Heat Treatment
Metallography
Suppliers (beta)
Direct Suppliers
Alternative Suppliers
Extended Range
Stress Strain Diagrams
Flow Stress Flow Strain
Fatigue Data*
Fracture Mechanics
Creep Data
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Figure 8-6

Example 4

I work in the USA and my field of interest is design of tubes for gas transport. The tubes should have tensile strength of up to 450 MPa, and should be made from a high temperature steel. Can **KEY to METALS** find the right SAE steel for me?

You have very elegant solution for this problem. Click *Advanced Search* from the main window. Next, choose **USA/SAE** in the *Country/Standard* field, choose **alloy steels** from the *Metal group* field. Within the *Mechanical Properties* group, enter **450** in the *tensile strength Max* field, and click on the Search button (Figure 8-7). The search results screen appears (Figure 8-8).

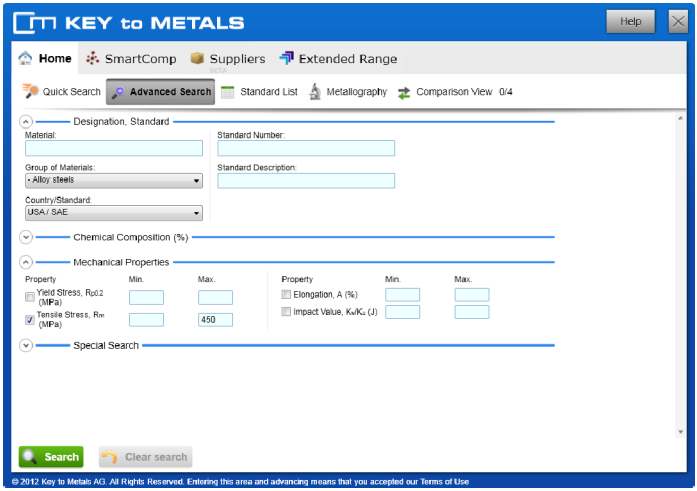

Figure 8-7

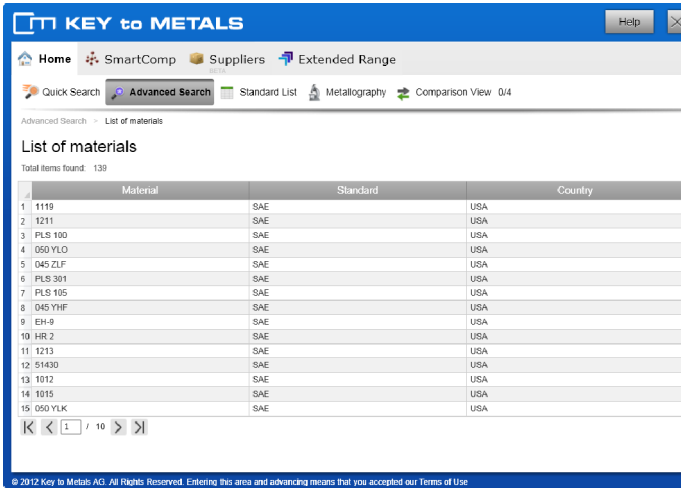
KEY to METALS
Help
Home
SmartComp
Suppliers
Extended Range
Quick Search
Advanced Search
Standard List
Metallography
Comparison View 0/4
Advanced Search > List of materials
List of materials
Total items found: 139
Material
Standard
Country
1 1119 SAE USA
2 1211 SAE USA
3 PLS 100 SAE USA
4 050 YLO SAE USA
5 045 ZLF SAE USA
6 PLS 301 SAE USA
7 PLS 105 SAE USA
8 045 YHF SAE USA
9 EH-9 SAE USA
10 HR 2 SAE USA
11 1213 SAE USA
12 51430 SAE USA
13 1012 SAE USA
14 1015 SAE USA
15 050 YLK SAE USA
1 / 10
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Figure 8-8

Example 5

I know the chemical composition of a Japanese steel:

C	0.15 – 0.26
Si	< 0.35
Mn	< 1.5
P	< 0.035
S	< 0.040
Mo	0.4 – 0.6

Can **KEY to METALS** find the steel designation and its mechanical properties?

Yes, positively. Click *Advanced Search* from the main window. Next, choose **Japan/JIS** in the *Country/Standard* field. Within the *Chemical Composition* group, check the known parameters, enter values and click the right arrow icon (Figure 8-9). The search results screen appears. Click on a material (Figure 8-10) to get the standard subgroup, and click the appropriate link to display material properties.

> **Important note: Although materials can be found from their chemical composition by using Advanced Search, it is SmartComp, an optional software add-on to KEY to METALS, that is developed specifically for identifying metals from their analysis.**
>
> **SmartComp is based on unique, patented SmartMetals(TM) technology, and is recognized and used by the world's most prominent companies, including worldwide leading spectrometers producers, for which it has been developed as a specialized OEM service. You may find more details on:**
>
> http://www.keytometals.com/smartcomp

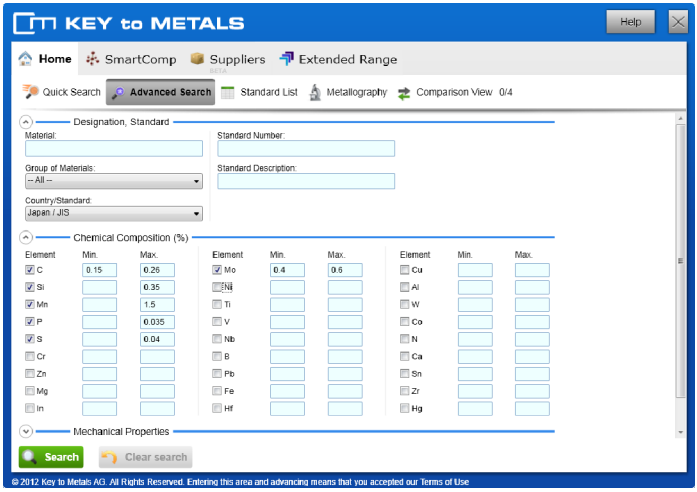
KEY to METALS
Help
Home
SmartComp
Suppliers
Extended Range
Quick Search
Advanced Search
Standard List
Metallography
Comparison View 0/4
Designation, Standard
Material:
Standard Number:
Group of Materials:
-- All --
Standard Description:
Country/Standard:
Japan / JIS
Chemical Composition (%)
Element Min. Max. Element Min. Max. Element Min. Max.
C 0.15 0.26 Mo 0.4 0.6 Cu
Si 0.35 Ni Al
Mn 1.5 Ti W
P 0.035 V Co
S 0.04 Nb N
Cr B Ca
Zn Pb Sn
Mg Fe Zr
In Hf Hg
Mechanical Properties
Search
Clear search
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Figure 8-9

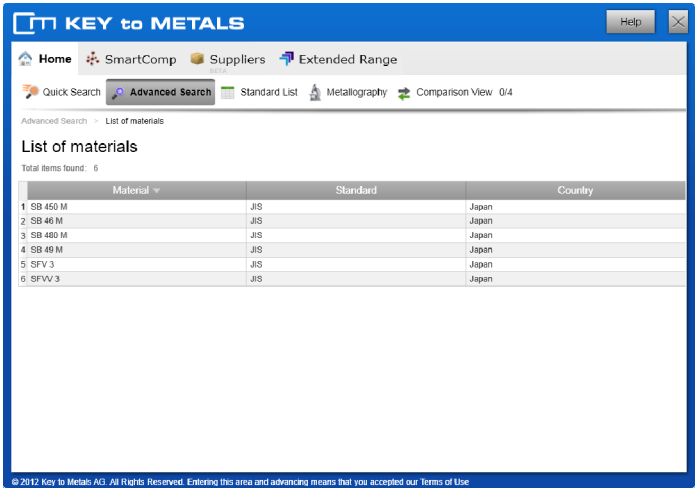
KEY to METALS
Help
Home
SmartComp
Suppliers
Extended Range
Quick Search
Advanced Search
Standard List
Metallography
Comparison View 0/4
Advanced Search > List of materials
List of materials
Total items found: 6
Material
Standard
Country
1 SB 450 M JIS Japan
2 SB 46 M JIS Japan
3 SB 480 M JIS Japan
4 SB 49 M JIS Japan
5 SFV 3 JIS Japan
6 SFVV 3 JIS Japan
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Figure 8-10

Example 6

I know the chemical composition of a copper alloy:

Al 8.0 – 11.0

Ni 3.0 – 7.0

Fe 3.0 – 7.0

Mn 0.1 – 1.5

Can **KEY to METALS** find the alloy designation?

Yes, positively. Click *Advanced Search* from the main window. Next, choose **Copper** from the *Metal Group* dropdown list. Within the *Chemical Composition* group, check the known parameters, enter values (Figure 8-11) and click the Search button. The search results screen appears. Click on a material (Figure 8-12) to get the standard subgroup, and click the appropriate link to display material properties.

Important note: Although materials can be found from their chemical composition by using Advanced Search, it is SmartComp, an optional software add-on to KEY to METALS, that is developed specifically for identifying metals from their analysis.

> **SmartComp is based on unique, patented SmartMetals(TM) technology, and is recognized and used by the world's most prominent companies, including worldwide leading spectrometers producers, for which it has been developed as a specialized OEM service. You may find more details on:**
>
> http://www.keytometals.com/smartcomp

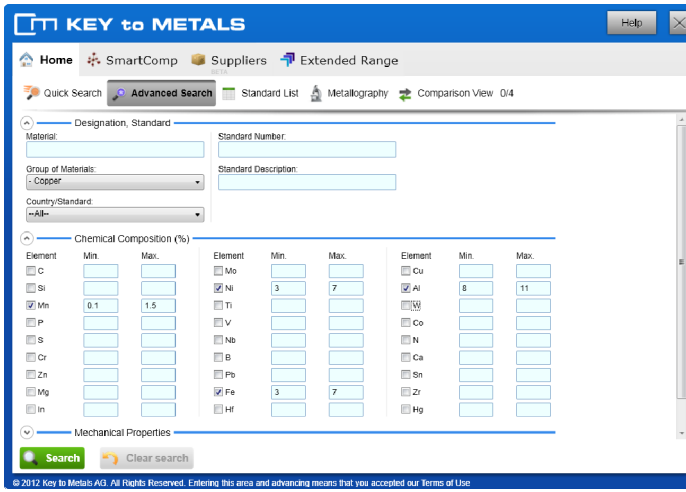

Figure 8-11

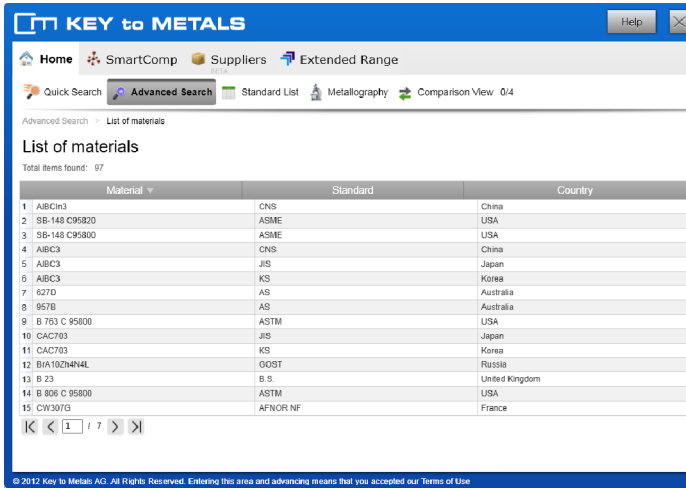

Figure 8-12

Example 8

I design valves and I use UNI steel X6CrTi12. Can **KEY to METALS** show me material data on the following temperatures: 100, 200, 300 degrees Celsius?

Indeed. Run *Advanced Search* from the main window. Next, enter the designation **X6CrTi12** in the Material field, and choose *Italy/UNI* in the *Country/Standard* field. Within the *Special Search* group, check *Properties on Elevated Temperatures* (Figure 8-13). Click the Search button and the search results screen appears. Click on a material to get the standard subgroup, and click the *on Elevated Temperatures* link to display material properties (Figure 8-14). Note the radio button for selecting *Measurement Units*, *Metric* (SI) or *Anglo-Saxon*.

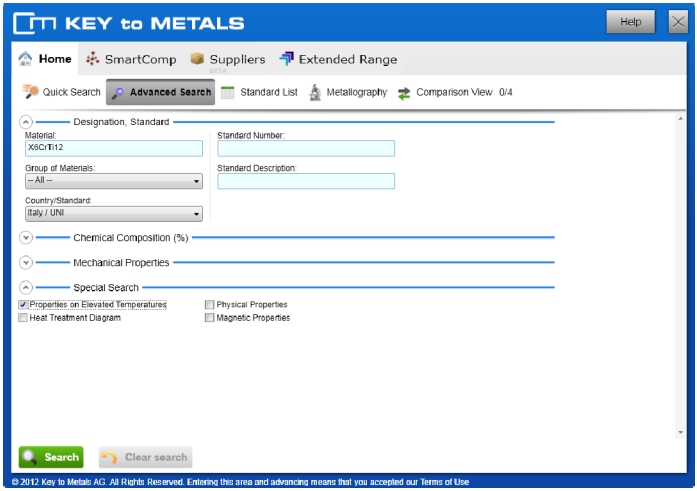

Figure 8-13

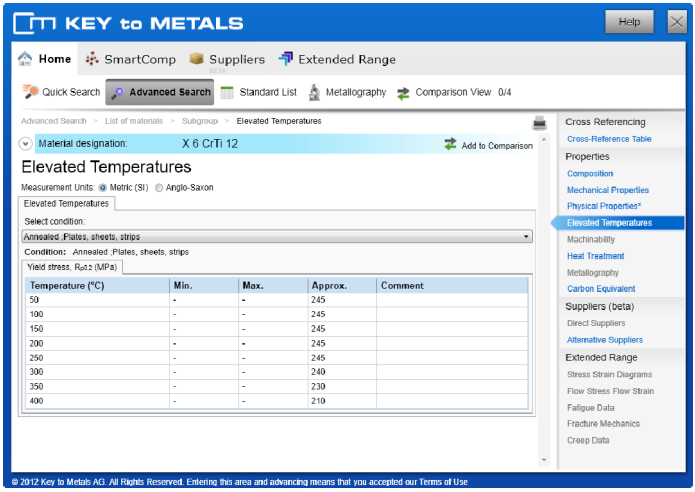
KEY to METALS
Help
Home
SmartComp
Suppliers
Extended Range
Quick Search
Advanced Search
Standard List
Metallography
Comparison View 0/4
Advanced Search > List of materials > Subgroup > Elevated Temperatures
Material designation: X 6 CrTi 12
Add to Comparison
Elevated Temperatures
Measurement Units: Metric (SI) Anglo-Saxon
Elevated Temperatures
Select condition:
Annealed ,Plates, sheets, strips
Condition: Annealed ,Plates, sheets, strips
Yield stress, Rp0.2 (MPa)
Temperature (°C) Min. Max. Approx. Comment
50 - - 245
100 - - 245
150 - - 245
200 - - 245
250 - - 245
300 - - 240
350 - - 230
400 - - 210
Cross Referencing
Cross-Reference Table
Properties
Composition
Mechanical Properties
Physical Properties*
Elevated Temperatures
Machinability
Heat Treatment
Metallography
Carbon Equivalent
Suppliers (beta)
Direct Suppliers
Alternative Suppliers
Extended Range
Stress Strain Diagrams
Flow Stress Flow Strain
Fatigue Data
Fracture Mechanics
Creep Data
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Figure 8-14

Example 10

I have a standard specification of a material, EN 29453. However, I do not know the corresponding list of materials defined by the standard. Can **KEY to METALS** find such materials?

Yes. Click *Advanced Search* from the main window. Type **EN 29453** in the *Standard Number* field (Figure 8-15). Click on the Search button and the search results screen appears.

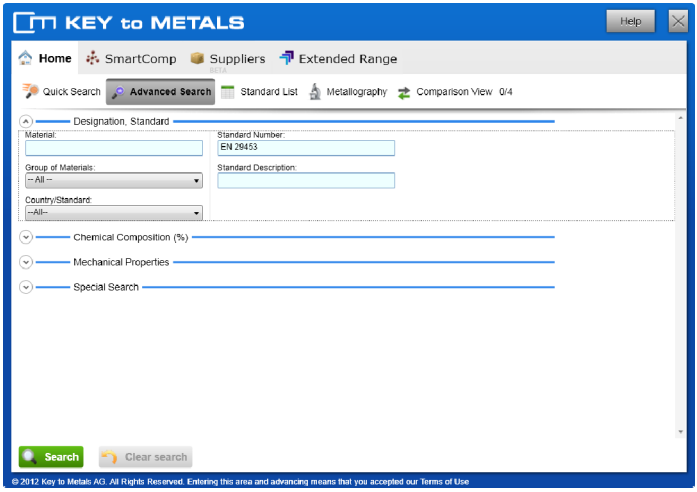

Figure 8-15

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